an open-circuit voltage (Voc) of the solar cell **100**. Accordingly, the open-circuit voltage and the short-circuit current of the solar cell **100** can be increased by the anti-reflection layer **22**, and thus, the efficiency of the solar cell **100** can be enhanced.

The anti-reflection layer **22** may include one or more of various materials. For example, the anti-reflection layer **22** may include a silicon nitride layer. However, the invention is not limited thereto. Thus, the anti-reflection layer **22** may have a single film structure or a multi-layer film structure including, for example, at least one material selected from a group including silicon nitride, silicon nitride including hydrogen, silicon oxide, silicon oxy nitride, MgF_2, ZnS, TiO_2 and CeO_2.

The first electrode **24** is electrically connected to the emitter layer **20** by penetrating the anti-reflection layer **22** at the front surface of the semiconductor substrate **10**. The first electrode **24** in plan view may have various shapes. For example, as shown in FIG. **2**, the first electrode **24** may include a plurality of finger electrodes **24***a*. The finger electrodes **24***a* are parallel to each other and are spaced apart from each other with a first distance D**1**. Also, the first electrode **24** may include a bus bar electrode **24***b* extending in a direction crossing the finger electrodes **24***a* to connect to the finger electrodes **24***a*. The bus bar electrode **24***b* may include a single bus bar electrode **24***b*, or the bus bar electrode **24***b* may include a plurality of bus bar electrodes **24***b* as shown in FIG. **2**. The plurality of bus bar electrodes **24***b* are spaced apart from each other with a second distance D**2** that is larger than the first distance D**1**. Here, a width W**1** of the finger electrode **24***a* may be smaller than a width W**2** of the bus bar electrode **24***b*. However, the invention is not limited thereto, and thus, the width W**1** of the finger electrode **24***a* may be the same as the width W**2** of the bus bar electrode **24***b*. That is, the shape of the first electrode **24** is described as an example, and thus, the invention is not limited thereto. Also, the first electrode **24** may include one or more of various materials.

Referring to FIG. **1** again, the back surface field layer **30** of the second conductive type is formed at the back surface of the semiconductor substrate **10**. Here, the back surface field layer **30** may include a second dopant **302** of the second conductive type and a second counter dopant **304** of the first conductive type opposite to the second conductive type.

A n-type dopant such as a group V element (for example, phosphorus (P), arsenic (As), bismuth (Bi), antimony (Sb), or the like) may be used for the second dopant **302**. A p-type dopant such as a group III element (for example, boron (B), aluminum (Al), gallium (Ga), indium (In) or the like) may be used for the second counter dopant **304**. However, the invention is not limited thereto, and thus, the second dopant **302** and the second counter dopant **304** may be formed of one or more of various elements or materials.

In the embodiment, the back surface field layer **30** as the dopant layer includes the second counter dopant **304**, along with the second dopant **302**. Accordingly, the back surface field layer **30** can have a sufficient thickness, and the recombination velocity can be reduced by decreasing the surface concentration of the back surface field layer **30**.

For example, the back surface field layer **30** may have sheet resistance of about 50~150 ohm/square (ohm/□), and may have a thickness of about 0.3~1.5 μm (for example, 0.5~1.2 μm). However, the invention is not limited thereto. Thus, the sheet resistance and the thickness of the back surface field layer **30** may be changed.

Here, a doping concentration of the second counter dopant **304** is less than a doping concentration of the second dopant **302**, and the back surface field layer **30** has the second conductive type. For example, the ratio of the doping concentration of the second counter dopant **304**: the doping concentration of the second dopant **302** may be about 1:3 to 1:30. When the ratio is above 1:30, the reduction of the surface concentration due to the second counter dopant **304** may be small. When the ratio is below 1:3, the property of the back surface field layer **30** may be deteriorated. Here, when the ratio of the doping concentration of the second counter dopant **304**: the doping concentration of the second dopant **302** is about 1:5 to 1:15, the second counter dopant **304** has a great effect.

The concentration difference between the second counter dopant **304** and the second dopant **302** may originate in a doping amount difference between the second counter dopant **304** and the second dopant **302**. In this case, the doping amount of the second counter dopant **304** and the second dopant **302** can be detected by secondary ion mass spectroscopy and so on.

The passivation layer **32** and the second electrode **34** may be formed at the back surface of the semiconductor substrate **10**.

The passivation layer **32** may be substantially at the entire back surface of the semiconductor substrate **10**, except for the portions where the second electrode **34** is formed. The passivation layer **32** passivates defects at the back surface of the semiconductor substrate **10**, and eliminates the recombination sites of minority carrier. Thus, an open circuit voltage (Voc) of the solar cell **100** can be increased.

The passivation layer **32** may include a transparent insulating material for passing light. Thus, the light can be incident to the back surface of the semiconductor substrate **10** through the passivation layer **32**, and thereby enhancing the efficiency of the solar cell **100**. The passivation layer **32** may have a single film structure or a multi-layer film structure including, for example, at least one material selected from a group including silicon nitride, silicon nitride including hydrogen, silicon oxide, silicon oxy nitride, MgF_2, ZnS, TiO_2 and CeO_2. However, the invention is not limited thereto, and thus, the passivation film **32** may include one or more of various materials.

The second electrode may include a metal having a high electric conductivity. Also, the second electrode **34** may have a structure similar to the structure of the first electrode **24** shown in FIG. **2**, and thus, the descriptions of the detailed structure of the second electrode **34** will be omitted.

Likewise, the emitter layer **20** includes the first dopant **202** and the first counter dopant **204**, and the back surface field layer **30** includes the second dopant **302** and the second counter dopant **304**. Accordingly, each of the emitter layer **20** and the back surface field layer **30** can have sufficient thicknesses, and the recombination velocity can be reduced by decreasing the surface concentration of the emitter layer **20** and the back surface field layer **30**. Accordingly, the efficiency of the solar cell **100** can be maximized. In the above embodiment, the semiconductor substrate **10** and the back surface field layer **30** have the n-type dopant for the second dopant **302**, and the emitter layer **20** has the p-type dopant for the first dopant **202**. However, the present invention is not limited thereto. Therefore, it is possible that the semiconductor substrate **10** and the back surface field layer **30** have the p-type dopant for the second dopant **302** and the emitter layer **20** has the n-type dopant for the first dopant **202**.

Also, in the above embodiment, the emitter layer **20** includes the first counter dopant **204** and the back surface field layer **30** includes the second counter dopant **304**. However, the present invention is not limited thereto. Thus, it is possible that the emitter layer **20** includes the first counter dopant **204** and the back surface field layer **30** does not